Effectiveness of HIV Prevention in Ontario, Canada: A Multilevel Comparison of Bisexual Men

Chad A. Leaver, MSc, Dan Allman, MSc, Ted Meyers, PhD, and Paul J. Veugelers, PhD

Objectives. We examined the effectiveness of community-level HIV prevention programming for men who have sex with men.

Methods. We used multilevel methods to examine unprotected intercourse by bisexual men (n = 1016) with male and female partners in geographic regions with and without HIV prevention programming.

Results. Men living in geographic regions with HIV prevention programming had significantly less frequent unprotected homosexual intercourse with both casual and regular partners. In contrast, no differences were observed for unprotected heterosexual intercourse.

Conclusions. This study provides evidence supporting the effectiveness of community-level HIV prevention programming and the need for its broader implementation. The study also demonstrates the suitability of multilevel methods for examining the effectiveness of community-level public health programs. (*Am J Public Health.* 2004;94:1181–1185)

The influence of contextual factors on disease risk is becoming increasingly important in epidemiological investigations for an understanding of population and individual determinants of health.[1–15] Epidemiological studies examining contextual factors have focused primarily on the influence of such socioeconomic contexts as income inequality, poverty, socioeconomic neighborhood characteristics, and social and cultural environment in explaining individual health outcomes.[4,16–25] Multilevel methods are becoming a standard methodological approach for examining the influence of contextual factors on individual health outcomes.[4,20–25] They also provide the means with which to evaluate contextual changes resulting from public health interventions.[26]

Public health interventions aimed at preventing new HIV infections are essentially designed to promote behavior change toward safer sexual behavior, with the ultimate goal of a decreased HIV incidence at the community level.[27] HIV prevention programming typically takes the form of promotional and educational media initiatives, targeted outreach that often includes distribution of condoms and educational materials, and the provision of various support and counseling services. The various aims of multiple and multidimensional approaches are to change attitudes, awareness, and cultural or community norms and to address access barriers to the provision of such services. Essentially, the overall aim of prevention programming is to change the context of risk behavior practices of at-risk populations at the community level.[28]

Studies in the United States and Canada that have evaluated HIV prevention strategies have focused primarily on behavioral differences in gay and bisexually identified men.[29] To our knowledge, no study among this population has evaluated contextual changes in sexual risk behavior for those residing in communities with and without prevention programming. Bisexual men provide the opportunity to simultaneously investigate the contextual influence of prevention programming in homosexual and heterosexual contexts of sexual behavior, with the former subject to various focused community-level HIV prevention programming initiatives and the latter not.

To further our understanding of contextual changes resulting from HIV prevention programming at the community level, we used multilevel approaches to examine the influence of prevention programming on unprotected intercourse with male and female partners among bisexual men in Ontario, Canada.

METHODS

The BiSex Survey

The BiSex Survey represents one of the few in North America and, until now, the only study in Canada focused exclusively on bisexuality. The Canadian province of Ontario was chosen because it reflects diversity of community size (numerous communities ranging from <500 000 residents to >1 million residents) and the proportion of bisexuals and sexual risk behavior for HIV among bisexual men observed in previous Canadian research.[30] The sampling strategy attempted to obtain a diverse sample of bisexual men via advertisement of a toll-free telephone number and an interviewer-assisted questionnaire.[31,32] Completion of the questionnaire required approximately 1 hour and collected information on personal and sociodemographic characteristics; sexual history; sexuality; sexual behavior with regular and casual male and female partners; sexual events and contexts; HIV testing experiences; health care use; and knowledge, attitudes, and beliefs about bisexuality and HIV/AIDS. No money or in-kind remuneration was provided to respondents. Interviews were conducted between March 11, 1996, and April 23, 1996.

Of the 1314 BiSex survey respondents, 65 (5%) were excluded because they did not provide their postal code information and 14 (1%) were excluded because they did not report sexual intercourse in the past year. An additional 219 (17%) were excluded because of incomplete information, leaving a sample of 1016.

Individual Characteristics

Individual characteristics collected from survey participants included age, marital status, education, employment status, income, self-identified sexual orientation, number of sexual partners by partner type in the previ-

ous year, and HIV testing behavior. The self-reported seroprevalence rate (5 men [0.4%]) was too low to allow for meaningful analyses.

Contextual Characteristics

In Ontario, AIDS Service Organizations (ASOs) are often the primary agencies responsible for HIV prevention programming and service provision. Residing within a catchment area of an ASO was considered as a contextual factor. There are 16 ASOs located throughout the province of Ontario. At the time of BiSex Survey data collection, 9 ASOs provided HIV prevention programming for men who have sex with men (MSM). ASOs were not involved in prevention programming directed toward male-to-female sexual behavior.

Statistical Approaches

The contextual influence of HIV prevention programming toward safer sexual behavior was examined using multilevel logistic regression. Individual characteristics, considered as first-level covariates, and the presence of HIV prevention programming provided by ASOs, considered as second-level covariates, were analyzed for their relationship with unprotected intercourse in the previous year. Specifically, in 4 separate subanalyses, we further examined unprotected intercourse with (1) regular female, (2) casual female, (3) regular male, and (4) casual male sexual partners. In these 4 subanalyses, we included all individual-level covariates that demonstrated a statistically significant association with unprotected intercourse in unilevel logistic regression models.

The analyses were conducted with HLM Version 5.01 (Scientific Software International, Lincolnwood, Ill) and SAS version 6.10 (SAS Institute, Inc., Cary, NC) for Windows 95 (Microsoft Corp., Redmond, Wash).

RESULTS

A total of 633 (62.3%) participants resided in 1 of the 9 ASO catchment areas with HIV prevention programming for MSM. Of the 1016 participants who reported sexual intercourse in the past year, 646 (63.6%) reported having at least 1 episode of unprotected intercourse with a male or female partner or both. A total of 870 (85.6%) reported sexual intercourse with at least 1 regular female partner, among whom 563 (64.7%) reported unprotected intercourse with this partner type. Two hundred thirty-three (22.9%) reported sexual intercourse with at least 1 casual female partner, among whom 47 (20.2%) reported unprotected intercourse. One hundred ninety-four (19.1%) reported sexual intercourse with at least 1 regular male partner, among whom 52 (26.8%) reported unprotected intercourse. Finally, 237 (23.3%) reported sexual intercourse with at least 1 casual male partner, among whom 35 (14.8%) reported unprotected intercourse. Further characteristics of BiSex Survey participants are presented in Table 1. The majority of the subjects in the sample were employed, earned greater than Can $20 000 per annum, and self-identified as bisexual. Approximately 40% of participants were married or living common law with a female partner; 42% were single, never married; and 17% were separated, divorced, or widowed. Participants were equally divided with respect to having been tested for HIV.

The unadjusted risk of unprotected intercourse with a male or female partner or both in the past year was higher in younger age groups. Compared with participants who were single and never married, significantly more unprotected intercourse was reported for bisexual men who were married or living common law or for those who were divorced, separated, or widowed (Table 1).

Table 2 presents the effects of HIV prevention programming on unprotected intercourse by sexual partner type. After adjusting for individual differences, bisexual men who resided in an area with HIV prevention programming engaged in substantially and significantly less unprotected intercourse with casual male partners compared with those residing in areas with no prevention programming. Similarly, bisexual men in areas with HIV prevention programming also engaged in substantially and statistically significantly less unprotected intercourse with their regular male partners. In contrast, unprotected intercourse with female partners (casual and regular) was not substantially or statistically significantly different between areas with or without HIV prevention programming (Table 2).

DISCUSSION

Our results suggest that the presence of HIV prevention programming for MSM is effective toward influencing safer sexual behavior with male but not female sexual partners of bisexual men.

There are various community organizations throughout the United States that provide HIV prevention programming. These US organizations are similar in mission and purpose to Canadian ASOs. Because they are influential community-based agencies, it is important to evaluate the effectiveness of their efforts. The evolution of these organizations primarily began as a community response to a new epidemic; therefore, we have no preintervention observations. It is for this reason that we made comparisons of geographic areas with and without HIV prevention programming for MSM. Participants in areas with prevention programming reported substantially less unprotected homosexual intercourse. These areas, at the time of the study, had no differential programming for the prevention of heterosexual transmission, and we observed no geographic differences for unprotected heterosexual intercourse. Because both observations originated from a single study population of bisexual men, they suggest that, in geographic areas with HIV prevention programming, the context of homosexual risk behavior has changed and the context of heterosexual risk behavior has not.

The effectiveness of HIV prevention programming in changing the context of homosexual risk behavior within communities adds to existing studies that have evaluated behavior changes of individuals.[34–51] To our knowledge, the only other study evaluating the contextual influence of an HIV intervention was undertaken by the Centers for Disease Control and Prevention in five comparison (intervention/nonintervention) US cities. The study demonstrated increased behavior change toward condom use in vaginal sex but did not report on homosexual intercourse.[26] This work represents a substantial contribution to evaluating the effectiveness of community interventions to change the con-

TABLE 1—Individual Characteristics and Presence of HIV Prevention Programming and Odds Ratios (ORs) for Unprotected Intercourse (n = 1016): Ontario BiSex Survey, 1996

	No. (%)	OR (95% Confidence Interval)
Age, y		
≤25	172 (16.9)	Reference
26–35	371 (36.5)	0.22 (0.13, 0.35)
36–45	305 (30.0)	0.34 (0.22, 0.53)
≥46	168 (16.5)	0.56 (0.37, 0.90)
Education		
≤Secondary	429 (42.2)	Reference
College/university	484 (47.6)	0.76 (0.48, 1.21)
≥Graduate/professional	103 (10.1)	0.70 (0.44, 1.11)
Income[a]		
≤$19 999	190 (18.7)	Reference
$20 000–$49 999	494 (48.6)	0.50 (0.35, 0.73)
≥$50 000	332 (32.7)	0.60 (0.45, 0.81)
Employment status		
Employed (full or part time)	789 (77.7)	Reference
Unemployed	108 (10.6)	0.79 (0.53, 1.19)
Other[b]	119 (11.7)	0.83 (0.48, 1.44)
Marital status		
Single	430 (42.3)	Reference
Married/common law	405 (39.9)	6.30 (4.54, 8.74)
Separated/divorced/widowed	172 (16.9)	1.81 (1.26, 2.59)
Self-identified sexual orientation		
Bisexual	763 (75.1)	Reference
Heterosexual	128 (12.6)	1.50 (0.99, 2.26)
Homosexual	47 (4.6)	0.61 (0.34, 1.10)
Other[b]	78 (7.7)	0.99 (0.61, 1.60)
Sexual behavior in the past year		
Women only	69 (6.8)	Reference
Men only	53 (5.2)	0.79 (0.46, 1.34)
Both women and men	894 (88.0)	0.36 (0.17, 0.76)
HIV testing behavior		
Never taken an HIV test	508 (50.0)	Reference
Tested for HIV	508 (50.0)	1.21 (0.93, 1.56)
HIV programming		
No programming	383 (62.3)	Reference
Programming	633 (37.7)	0.96 (0.73, 1.28)

Note. ORs for individual characteristics were calculated with unilevel logistic regression and for the presence of HIV prevention programming with multilevel logistic regression. The dependent variable was unprotected sexual intercourse with male or female partners (or both) in the past year.
[a]In 1996, the Canadian dollar approximated an average value of $0.70 in US dollars.[33]
[b]Other employment status includes individuals who were students and those who received social assistance from government or other sources. Other sexual orientation included those who chose "I do not choose to identify" as well as other responses such as transsexual, transgender, or "fluid."

TABLE 2—Odds Ratios (ORs) for Unprotected Intercourse, by Sexual Partner Type and Presence of HIV Prevention Programming: Ontario BiSex Survey, 1996

Sexual Partner	OR (95% Confidence Interval)
Regular female	
No programming	Reference
Programming	0.98 (0.74, 1.37)
Casual female	
No programming	Reference
Programming	1.41 (0.81, 2.50)
Regular male	
No programming	Reference
Programming	0.32 (0.21, 0.52)
Casual male	
No programming	Reference
Programming	0.39 (0.21, 0.74)

Note. ORs are calculated with multilevel logistic regression. The dependent variable for 4 separate multilevel analyses are unprotected intercourse with specified partner type: (1) regular female, (2) casual female, (3) regular male, and (4) casual male in the past year. The ORs for regular female partner are adjusted for age, marital status, and number of sexual partners in the past year. Those for casual female partner and for regular male partner are adjusted for age, and those for casual male partners are adjusted for age, martial status, and number of sexual partners. The ORs for casual female and regular male partners did not substantially alter when further adjusted for marital status and number of sexual partners. Similarly, none of the ORs changed substantially when further adjusted for potential socioeconomic confounders.

text of sexual risk behavior. The study also addresses the call for new means to assess "change in the HIV prevention fabric of the community."[52(p300)] However, in reality, public health practitioners are not often afforded the opportunity to conduct such detailed and comprehensive evaluations of interventions, particularly community-level interventions, which are often initiated by and from the community before the mobilization of public health initiatives. The present study provides an alternative analytic approach that is suitable for the evaluation of such community-level interventions.

The relatively high prevalence of unprotected intercourse, particularly in geographic regions without HIV prevention programming, is a serious public health concern, particularly in light of the increase in HIV incidence among gay and bisexual men noted in the United States and Canada and in other international studies.[53–59] This finding is also consistent with other studies reporting high levels of unprotected intercourse among bisexual men.[31–36,40–51] These results clearly indicate the importance of addressing homo-

sexual risk reduction for bisexual men and demonstrate the need for inclusive prevention initiatives that also address heterosexual risk behavior.

The BiSex Survey recruitment strategy achieved a large sample size and is one of the few recognized as having accessed the hidden populations of MSM.[31,32,60–63] However, this strategy introduces selection bias, particularly, volunteer bias. For example, participants more receptive to media messages may have an increased awareness of HIV prevention campaigns and the risks of unsafe sex and potentially may be more likely to participate in the study. A selective overrepresentation of such participants in geographic areas with HIV prevention programming could potentially account for the observed differences in homosexual risk behavior. If the mechanism, in this example, was participants' receptivity to media messages, one would then also expect that participants residing in geographic areas with HIV prevention programming would report less heterosexual risk behavior, which we did not observe. It is therefore reasonable to assume a relatively limited effect of volunteer bias on the observed contextual differences and on the inferred supporting evidence for the contextual effectiveness of HIV prevention programming. As a second limitation, we acknowledge the limited means of defining context through postal codes and the limited ability to adjust for contextual confounders. Moreover, as participants may engage in contexts other than those determined by their postal codes, one should be aware of the potential for contextual misclassification and consequent bias in the estimates of the importance of HIV prevention programming.

In summary, this study furthers our understanding of the contextual influence of community-level public health interventions. The significance of HIV prevention programming to influence safer sexual behavior among bisexual men in homosexual but not heterosexual contexts supports the benefits of inclusive and comprehensive programming efforts. This study also demonstrates the suitability of multilevel methods for examining the effectiveness of community-level public health programs. ■

About the Authors

At the time of the study, Chad A. Leaver was a student in the Department of Community Health and Epidemiology, Dalhousie University, Halifax, Nova Scotia. Paul J. Veugelers is with the Department of Community Health and Epidemiology, Dalhousie University. Ted Myers and Dan Allman are with the HIV, Social, Behavioural and Epidemiological Studies Unit, University of Toronto, Toronto, Ontario.

Requests for reprints should be sent to Paul J. Veugelers, PhD, Department of Community Health and Epidemiology, Dalhousie University, 5790 University Avenue, Halifax, Nova Scotia B3H 1V7, Canada (e-mail: paul.veugelers@dal.ca)

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Contributors

C.A. Leaver conceived the study, conducted the statistical analyses, and was the principal author. P.J. Veugelers developed the methodological approach and assisted in the statistical analyses and the development of the article. T.Myers conceived the BiSex Survey from which these data originated and contributed to the interpretation of findings. D. Allman provided feedback to the article.

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Human Participant Protection

This analysis of secondary data was approved by the health sciences human research ethics board of Dalhousie University, Halifax, Nova Scotia.

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